

Benthic Marine (Seafloor) Update at Kalaupapa National Historical Park

Kalaupapa National Historical Park (KALA) is located in Hawai'i on the north shore of the island of Moloka'i. Found within KALA's nearly 2,000 acres of nearshore marine waters are a variety of submerged marine resources, species, and habitats. The typical marine habitat is highlighted by large boulders and coral reefs. Coral reefs provide habitat for thousands of organisms. A growing and reproductively active reef is a sign of a healthy marine ecosystem and upland water system.

METHODS & MEASUREMENTS

Divers annually monitor coral reefs by recording the abundance of coral and other bottom dwelling species through photographic interpretation (pictures of the seafloor taken every meter to detect plant and animal species, disease, and bleaching), rugosity chains, and coral settlement arrays.

From 2006-2010, a total of 150 twenty-five meter transects (the sampling unit) were surveyed, with 30 transects surveyed annually. Fifteen transects were randomly established at the onset in 2006 as permanent transects and subsequently surveyed on an annual basis. The remaining 15 temporary transects were randomly selected each year and surveyed only in that year.

The benthic monitoring program at KALA consists of four components obtained through SCUBA surveys:

1. The 25 photographs taken along each transect are analyzed to assess long-term changes in the percent cover (how much of the seafloor is covered in corals, algae, or invertebrates). Changes may indicate certain environmental stressors or drivers. For example, an increase in algae has been associated with increased nutrient levels or a reduction in the number of herbivorous invertebrates or fishes.
2. Also assessed from the photographs is the incidence of coral disease and bleaching. Physical water conditions (e.g., temperature) often correlated with disease or bleaching are monitored through other [Vital Signs](#).
3. Rugosity is a measure of structural complexity of the seafloor (bumpiness or topography of the seafloor). Changes in rugosity may indicate large scale changes in community structure, composition, function, and condition. Research has established a strong link between rugosity and the abundance of fishes and mobile invertebrates.
4. Coral reef populations must successfully reproduce and recruit to persist. The failure of juveniles to recruit can result in relatively rapid degradation of the coral reef ecosystem. [Coral settlement](#) rates of coral larvae provide an integrated measure of larval supply, suitable substrate (favorable places to settle), and water quality. Coral settlement is estimated by assessing new coral larvae settling on ceramic tiles set up along transects.



Boulder habitat typical of a survey transect at Kalaupapa NHP



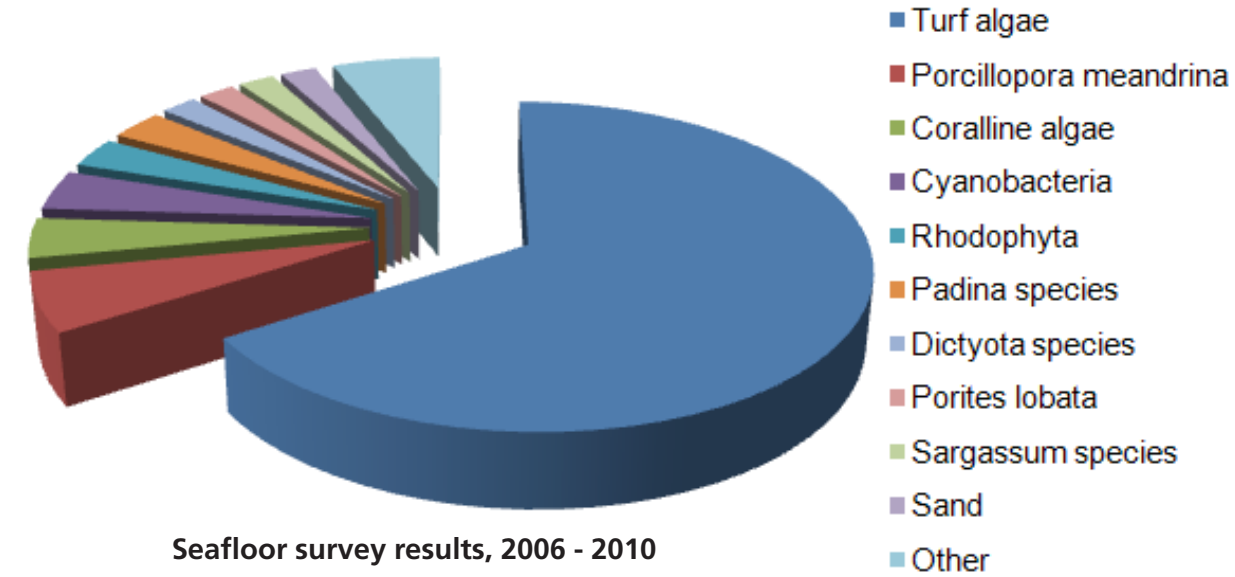
25 photographs of the seafloor are taken along each transect



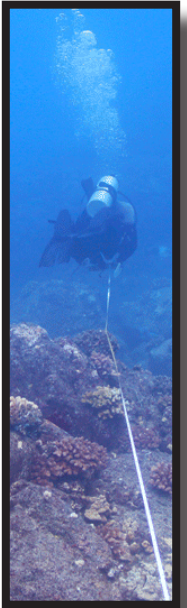
Each photograph is analyzed to detect the presence of different species or disease

OBSERVATIONS & TRENDS

- Average coral cover remained relatively stable at 9%. Transects with the most coral were located near the northern tip of the peninsula, while the lowest coral cover values were concentrated near the eastern and western boundaries of the park.
- Coral species diversity remained stable. The total number of unique coral species was 22, with an average of over four species per transect.



Seafloor survey results, 2006 - 2010



- Coralline algae was relatively unchanged from 2006 to 2010, and averaged 4%. Transects with the highest amount of coralline algae were near the northeastern tip of the peninsula.
- Turf algae decreased from 76% in 2006 to 60% in 2008, and then increased to 64% by 2010.
- Macroalgae cover was slightly higher near the eastern and western boundaries of the park below the cliffs. Average macroalgae cover increased from 8% in 2006 to 26% in 2008, and then to 22% in 2010. This trend, however, is not significant.
- The percentage of photoquadrats showing signs of disease or bleaching was generally low and ranged from 0.3% in 2007 to a high of 4% in 2010, with an overall average of 1.3%. The increase in coral disease/bleaching was statistically significant across years. Transects with the highest incidence of disease/bleaching were located around the northern end of the peninsula and at one site on the western boundary of the park.
- Rugosity was generally higher along the northeastern edge of the peninsula and less below the cliffs. The survey data indicated no ecologically relevant change in relief.
- Coral settlement rates were not statistically different among years. *Porites sp.* were the most common larvae identified, followed by *Montipora sp.* and *Pocillopora sp.*. Coral larvae settlement was the highest near the northern tip of the peninsula, and lowest near the eastern and western boundaries of the park.

As of 2010, the benthic community at Kalaupapa National Historical Park appeared stable and was typical of other north shore coral reefs in the Hawaiian Islands.